GEOMAGNETIC MEASUREMENTS IN MACEDONIA

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ABSTRACT

From 2002 to 2004 the scientific team in the Department of Geology and the Geophysics at the Faculty of Mining and Geology Stip led by Dr. Jean Rasson (from the Royal Meteorological Institute - Geomagnetic Observatory in Dourbes, Belgium) developed the basic geomagnetic net of 15 measure points on the territory of the Republic of Macedonia.
During 2003 and 2004 surveys were carried out on all measure points of the magnetic field (T, D, I). It was the first defining of the basic parameters of normal geomagnetic field in the territory of the Republic of Macedonia. Measurements were carried out with the equipment from the Observatory in Dourbes, Belgium.
The University "Goce Delcev", Stip which is currently in the process of amendments opens the possibility for establishing a Geomagnetic Observatory in the territory of the Republic of Macedonia.
So far, detailed measurements have been carried out on several localities in order to meet the requirements of INTERMAGNET for the determination of the site for the founding of the Observatory. It was determined the construction site to be in Mt. Plackovica.

1 INTRODUCTION

Over the past years the geomagnetic measurements carried out on the territory of the Republic of Macedonia and on other territories of former Yugoslavia were conducted by the Grocka Geomagnetic Observatory in Belgrade.

After the declaration of independence of the Republic of Macedonia, activities started for establishing a geomagnetic observatory in the country. In that regard, the project entitled Establishing a Geomagnetic Observatory on the Territory of the Republic of Macedonia According to the INTERMAGNET Standards started implementation as a joint project between the Faculty of Mining and Geology - Department of Geology and Geophysics and the Royal Meteorological Institute - the Observatory in Dourbes.

Project leaders are Prof. Dr. Todor Delipetrov and Dr. Jean Rasson. The paper presents the results obtained during the past three years. The activities extended by Dr. Jean Rasson in the geomagnetic investigations and the creation of the net for the repeat stations and the selection of the site for the geomagnetic observatory, particularly the transfer of knowledge and training of educated people in the field of geomagnetism are worth of note.

2 GENERAL

The Republic of Macedonia occupies an area of 25.713 km^2 in the central part of the Balkan Peninsula.

The geomagnetic observatories in neighboring countries are as follows:
- Panaguriste, Bulgaria;
- Pedeli, Greece;
- Grocka, Serbia and Montenegro;
- Aquila, Italy.

Figure 1. Geomagnetic observatories in neighboring countries

The territory of the Republic of Macedonia covers a small area. Its evolution, however, is rich in geological event, in various kinds of rocks, a large number of rare minerals, volcanism, seismicity and pronounced tectonics. These characteristics make the area interesting for geological and geophysical studies.

Figure 2. Map of the regional tectonic setting - I. Cukali - Krasta; II. Western Macedonian zone; III. Pelagonian massif; IV. Vardar zone; V. Serbo - Macedonian massif; VI. Kraistide zone

According to the global tectonic regional setting of the Balkans, the territory of the Republic of Macedonia includes part of the Rhodop mass to the east, and the Dinaride - Alpine system to the west.

The territory has been divided into tectonic regional settings based on investigations carried out so far

3 MEASUREMENTS IN MACEDONIA

The first geomagnetic measurements carried out in Macedonia were those in Ohrid on 20 October 2002 on Mt Galicica on a spot with coordinates as follows: Lat: 40°57'23"N Long: 20°48'51"E Alt: 1691m. The spot is more than 100 meters far from the main road that connects Ohrid and Resen.

The equipment measured the declination, inclination and total field. The equipment used included:

- 1 Diflux/GPS receiver type FLM3/A serial 001
- 1 Proton magnetometer Geometrics G816 (electronics + sensor) serial 1579
- 1 Geodetic Tripod
- 1 Monocular digital compass KVH Data scope II pn#01-0162 Serial 02070033
- 1 Portable Dell computer

Such measurements of the geomagnetic field necessitate finding the targets first. The target should be such that will not disappear in the near future e. g. churches, big antennas, mosques etc. The next step includes finding the azimuth and description of the targets that will help future measurements on the same spot and avoid finding targets again. Normally, the researchers selected several targets.

From the computer we read all data recorded by the variometer and proton magnetometer important for the declination, inclination and total field. All data collected were entered into the computer.

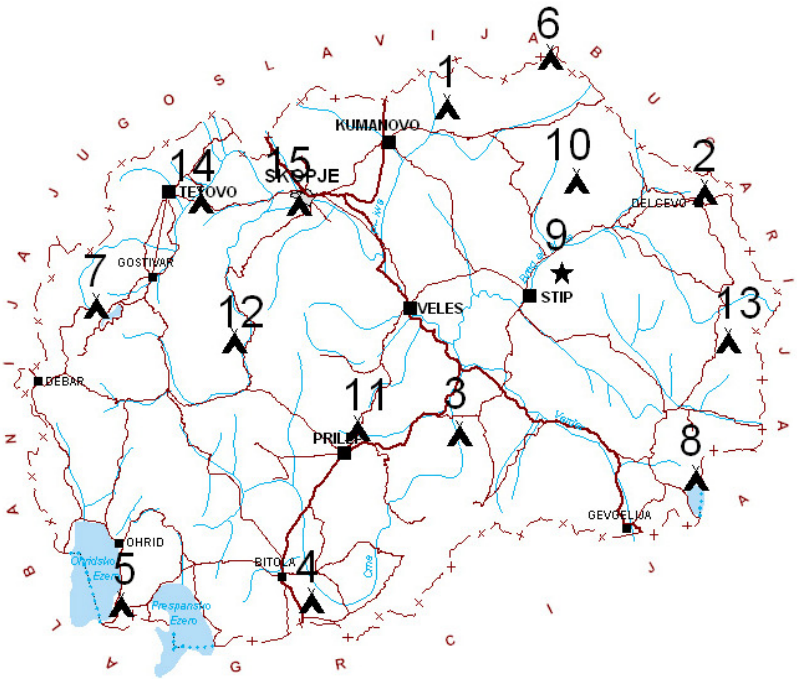

Figure 3. Map of geomagnetic stations

However, in our case we did not use a variometer and proton magnetometer for the measurements in Ohrid. Instead, we used the data from the closest magnetic observatories such as the magnetic observatory of Pedeli in Greece, Aquila in Italy, Grocka in Serbia and Montenegro etc. The results obtained made it possible to carry out complete magnetic measurements.

During 2003 a total net of repeat stations for Macedonia was compiled which can ba seen in Figure 3.

Table 1. Geographic coordinates of the measured stations

Measure point	Geographic latitude	Geographic longitude	Altitude
1. "Bajlovce"	42° 13' 16"	21° 55' 17"	592 m
2. "Crna Skala"	41° 59' 41"	22° 47' 28"	833 m
3. "Gradot Island"	41° 23' 15"	21° 57' 06"	317 m
4. "Egri"	40° 57' 56"	21° 26' 54"	626 m
5. "Galicica"	40° 57' 23"	20° 48' 51"	1684 m
6. "Luke"	42° 20' 39"	22° 16' 29"	1180 m
7. "Mavrovo"	41° 42' 58"	20° 43' 38"	1418 m
8. "Nikolic"	41° 15' 54"	22° 44' 36"	300 m
9. "Plackovica" - location for	41° 47' 41"	22° 18' 13"	677 m
geomagnetic	42° 01' 35"	22° 21' 29"	1618 m
observatory	41° 24' 11"	21° 36' 32"	870 m
10. "Ponikva"	41° 37' 38"	21° 11' 36"	837 m
11. "Prilep lake"	41° 36' 54"	22° 51' 46"	1252 m
12. "Sv. Marija	41° 59' 09"	21° 04' 46"	522 m
Precesna"	41° 58' 40"	21° 24' 57"	569 m
13. "Slivnica"			
14. "Tetovo-Zelino"			
15. "Vodno"			

The measurements during 2003 and 2004 year made it possible to compile maps which are shown in the next figures for the total vector T, declination D and inclination I.

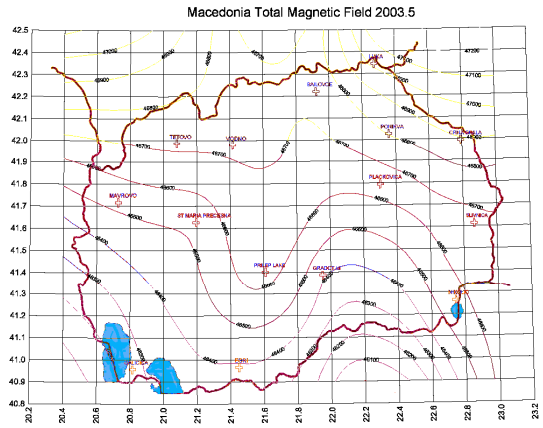

Figure 4. Map of total vector, T for 2003

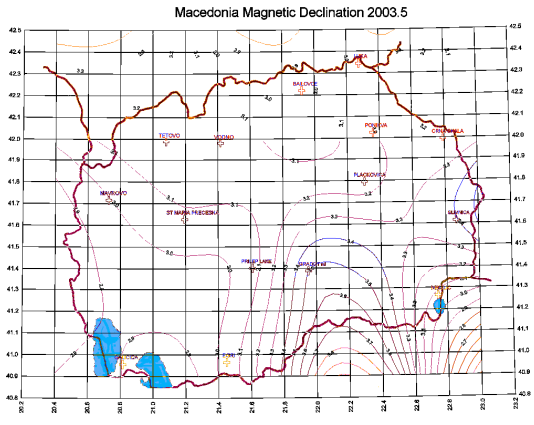

Figure 5. Map of declination, D for 2003

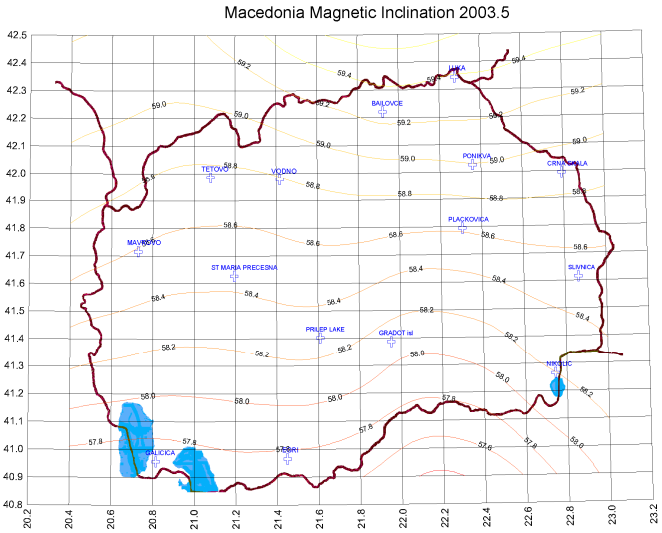

Figure 6. Map of inclination, I for 2003

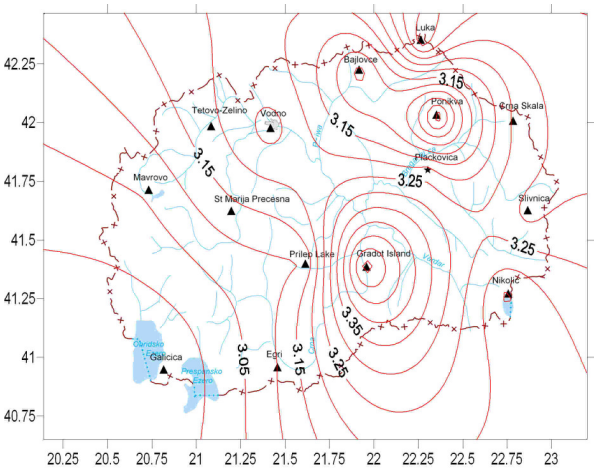

Figure 7. Map of declination, D for 2004

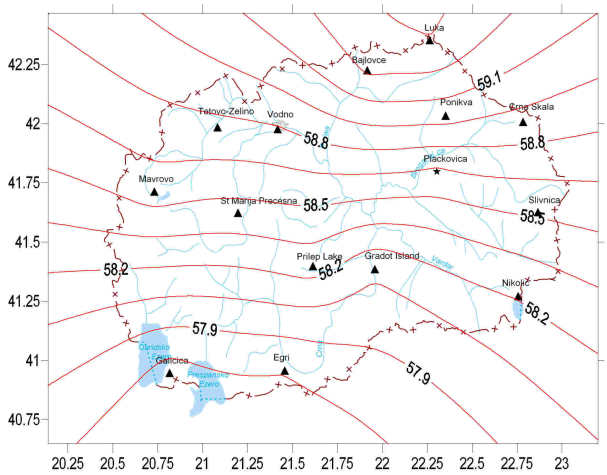

Figure 8. Map of inclination, I for 2004

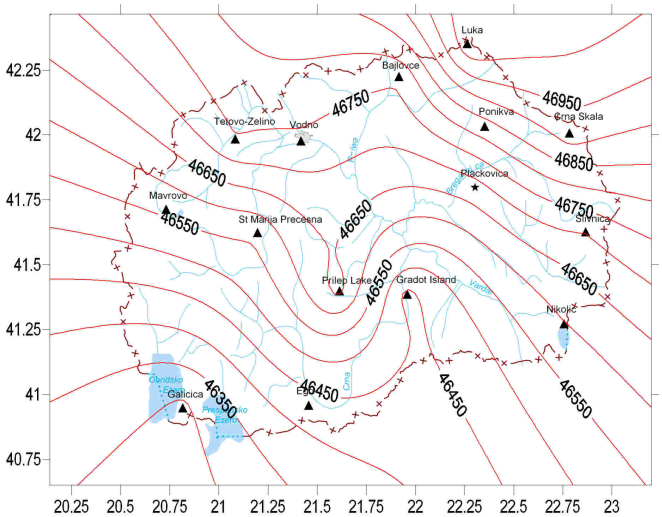

Figure 9. Map of total vector, T for 2004

4 CONCLUSIONS

The activities carried out so far resulted in:
- final decision that Mt. Plackovica, Eastern Macedonia to be the site for the geomagnetic observatory; geomagnetic gradient at this place is 1 nT/m;
- creation of a network of repeat stations;
- compilation of maps of the total vector T, declination D and inclination I.

The activities carried out are a good ground for establishing the geomagnetic observatory so that Macedonia can join the countries that give their contribution to the following and the study of the geomagnetic field.

REFERENCES

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[2] *Map of Z-component of geomagnetic field in Republic of Macedonia*
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